CPSC 2150 A5 Complexities

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Part 1)

Text

Description automatically generated

Part 2)

\*Note all complexity calculations were done with 4000 elements and 8000 elements to minimize potential error\*

**Cases for Quick Sort:**

1. Best Case: Random Order
2. Avg Case: Ascending Order
3. Worst Case: Descending Order

Best case and average case for Quick Sort is O(n log (n)), however it’s worst case may perform at O(n^2).

For best case of Quick sort: random order, 4000 elements time 72393 / 4000 is 18. In comparison, 8000 elements time is 155797 / 8000 is 20.

From this we can assure time complexity increased per increase in number of element is very minimal and is less than linear. For random insertion, complexity is closer to the base case ( O(n log(n)).

For worst case: Ascending Order, 4000 elements time is 3000497 / 4000 which is 750 and 8000 elements 10653213/ 8000 which is 1331. From the time complexity calculation, we can derive that time complexity for ascending order is close to being a linear.

**Cases for Merge Sort:**

1. Best Case: Ascending Order
2. Avg Case: Random order
3. Worst Case: Descending Order

Merge Sort has a best, average, and worst case of O(n log(n))

Best case for merge sort is descending order. With 4000 elements resulting in 246137/ 4000 = 61 and 373634 / 8000 which is 46.7. I’ve noticed that the discrepancy between the expected result and actual result is due to the cost of merge.

**Cases for Insert Sort:**

1. Best Case: Random Order
2. Avg Case: Ascending Order
3. Worst Case: Descending Order

Insertion sort has an average and worse case of O(n^2) and best case of Linear O(n) complexity.

Best case of insertion sort is Descending order which is 4000 elements 1427586/ 4000 = 356 and 8000 elements 13615130/ 8000 which is 1701, closer to average and worst case of O(n^2).

Worst case is random order which is 3718412 / 4000 = 929.603 and 15637959/ 8000 = 1954 which is linear. (Ascending Order had similar result)

Part 3.